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REMARKS

I. Interview Request

Applicants undersigned representative hereby formerly requests an interview with the Examiner to discuss the applied reference and Office Action. **The Examiner is requested to contact Applicant's representative by phone (732) 542-9070 upon receiving this Response to schedule the interview.** It is intended that this Response serve as the basis for the interview discussion in addition to being a formal response to the Office Action.

II. Introduction

Claims 1-37 are pending. Applicants believe all of the pending claims clearly distinguish over the applied references. Accordingly, none of the claims have been amended.

Claims 1-2, 10 14-15, 20-27 and 30-37 stand rejected under 35 U.S.C. §102(b) as being anticipated by the Shattil reference (WO 9941871). Claims 3-9, 11-13, 16-19 and 28-29 stand rejected under 35 U.S.C. §103(a) as being unpatentable over the Shattil reference in view of U.S. Patent No. 5,612,978 to Blanchard. Accordingly, in each of the rejections, the Shattil reference serves as the sole or primary reference used in rejecting the claims. The Blanchard patent does not make up for the deficiencies discussed below with regard to the Shattil

reference. Accordingly, the discussion below will focus primarily on the Shattil reference.

As will be discussed below, none of the references, alone or in combination, teach, disclose or suggest the claimed subject matter.

III. The Present Invention

As discussed in the pending patent application, various aspects of the invention are directed to methods and apparatus for use in an OFDM communications system wherein data symbols are generated, e.g., modulated, and **recovered in the time domain as opposed to the frequency domain.**

In various exemplary embodiments the transmitter of the present invention modulates data symbols in the time domain to a prescribed set of time instants corresponding to a symbol duration. The mapped symbols are smoothly connected to form the transmitted OFDM signal such that the generated signal corresponding to a user includes frequency components at the tones allocated to that particular user. The time domain OFDM signaling method of the present invention has the advantage over the known frequency domain OFDM signaling method in that it can, in many cases, provide a substantially lower peak-to-average ratio than known methods where the OFDM signal is constructed in the frequency domain.

In a multiple access system, the transmitted signals from different transmitters, each using a set of tones

allocated to a different user, are often mixed in the communications channel prior to arriving at an individual user's receiver. In accordance with one exemplary receiver embodiment of the present invention, in order to eliminate multiple access interference the receiver first samples the received signal and then transforms the signal from the time domain to the frequency domain, e.g., by performing an FFT operation. After the signal has been converted into the frequency domain, the signal is filtered to remove tones of other users. This results in a signal including the tones allocated to the user of the receiver but not other users.

After removal of the tones of other users from the signal, **the signal is converted back into the time domain to facilitate recovery of the transmitted symbols**, The symbols may then be recovered **from the time domain signal** by mapping values of the filtered time domain signal **at instants in time used to transmit symbol values to values in a set of symbol values.**

IV. The Pending Claims Are Patentable Over the Applied References

Applicants will now address and overcome each of the rejections.

1. The 102 (b) Rejection of Claims 1-2, 10, 14-15, 20-27 and 30-37

Claims 1-2, 10 14-15, 20-27 and 30-37 stand rejected under 35 U.S.C. §102(b) as being anticipated by the Shattil reference (WO 9941871).

A. Summary of the Reasons the Rejections under 102(b) should Be Withdrawn

The Examiner's reliance on filter 56 as disclosing the recited filtering step of claim 1 is based on an apparent miss-understanding of the described function of filter 56 in the applied reference. The filtering step of claim 1 **involves removing tones** included in a frequency division multiplexed signal which are not included in a set allocated to a first user. This occurs in claim 1 **after** "performing a time domain to frequency domain transform operation". **The filter 56 in the Shattil reference is NOT described as removing carriers or tones but rather separating a received CIMA signal into its N component carriers.** The Examiner seems to rely on the filter 56 for showing both a time domain to frequency domain operation and for performing filtering **after** the time domain to frequency domain operation. ***The Examiner's interpretation that the filter removes tones is not supported by the description of filter 56 in the applied reference and appears inconsistent with the discussion of separating the n carriers as opposed to eliminating carriers.*** Accordingly the reference does not anticipate or render obvious claim 1 or the other claims.

Thus **the rejection of the claims based on the Shattil reference should be withdrawn.**

B. Detailed Discussion of the Reasons the Rejections under 102(b) should Be Withdrawn

The rejection of claims 1-2, 10, 14-15, 20-27 and 30-37 and reasons why the rejection should be withdrawn will now be discussed in detail.

In rejecting the claims, and particularly claim 1, the Examiner states:

> Regarding claims 1 and 36-37, Shattil discloses a method of processing a frequency division multiplexed signal being OFDM (page 4, line 31-34) representing a plurality of symbols and including a plurality of tones, a first subset of said plurality of tones being allocated to a first user (page 7, lines 27-29 and page 12, lines 23-28) comprising the steps of **performing a time domain to frequency domain transform operation** on the frequency division multiplexed signal to generate a frequency domain signal there from (**page 7, lines 4-6**); **filtering** the frequency domain signal **to remove tones that allocated to a second users in said plurality of tones which are not included in said first subset of tones that allocated to the first user (Fig. 7, Ref 56 is a filter)**; performing a frequency domain to time domain transform operation on the filtered frequency domain signal to generate a time domain transform operation on the filtered frequency domain signal to generate a filtered time domain signal (Fig. 4, page 6, lines 1-10, page 12, lines 12-12) and recovering symbols transmitted to the first user from the filtered time domain signal (Fig 7, Ref 66, page 7, lines 10-13

and page 12, lines 12-14.) (Office Action page 2, bold added)

In the rejection the Examiner relies heavily on page 7, lines 4-29 and the description of Fig. 7 with particular reference to the discussion of the use of a filter 56. While the Examiner cites various elements as corresponding to the elements recited in the claims, Applicants respectfully submit that a careful review of the cited portions of the Shattil reference fail to disclose anything close to the claimed subject matter and that there seems to be a miss-understanding of what precisely the reference is doing. To understand the section relied upon by the Examiner it is useful to review the actual text of the reference in detail. Page 7 lines 3-29 of the reference state:

> Fig. 7 shows a single-user phase-space receiver that is capable of sampling in multiple phase spaces. **A received CIMA signal is detected from the communications channel** by a receiving element 52 **and down-converted by a mixer before being separated into *its N component carriers* by a frequency filter 56**. Depending upon how the transmit signal may have been altered by the communications channel, one of a plurality of **gain compensators** (not shown) may apply a gain compensation **to *each component n***. Then each gain-compensated component is split into a number M of delay components, each of which is delayed by a phase-spcae delay compensator 60mn. The output of each m-numbered delay component is summed at a combining step 62 to reconstruct pulses observed in other phase spaces. Each pulse may be delayed at a delay

> step 64m to scynchronize the pulses before being summed in a decision step 66 that outputs an estimate of the original transmit signal. In practice, the delay step 64m may be integrated into the decision step 66.
>
> This receiver obtains multiple samples of the pulse because it tracks the pulse through different phase spaces. Thus, the receiver benefits from the relatively slow data rate (i.e., pulse period) of the CIMA carriers which combine to create the pulses. This remedies the multipath problem of intersymbol interference. The short duration of each pulse allows the receiver to avoid the fading and distortion problems inherent in systems that receive slowly varying signals and the flat fading associated with narrowband signals. Although the pulse is comprised of many narrowband CIMA carriers, flat fading (which causes very deep fades) is avoided because the CIMA pulse depends on the interference pattern between a large number of CIMA carriers. Furthermore, if the number of and spacing between the CIMA carriers are appropriately chosen, it is unlikely that more than one CIMA carrier is located in a deep fade. Thus, frequency diversity is achieved,
>
> **Each user k can share the communication resource** through a unique selection of the phase offset (i.e., timing offset) **while employing the same carriers as other users.** If N orthogonal carriers are shared by each user k, then N users may use the resource without co channel interference. … (bold added)

Notably, the frequency filter 56 is NOT described as removing carriers or tones in the portion cited by the Examiner **but rather separating the CIMA signal "into its**

N component carriers". It does not describe eliminating any of the N carriers which Applicants believe the Examiner is equating to "tones". A review of the element labeled 56 in Fig. 7 shows the element 56 performs the function "Separate into Components". It does not indicate or suggest that the filter 56 is to remove carriers assigned to another user as the Examiner seems to suggest. In fact, is should be appreciated that one of the goals of the reference is to allow users to share the same carriers. Page 7 lines 24-26 make this objective of sharing carriers clear. As noted above, this portion of the applied reference states "**Each user k can share the communication resource** through a unique selection of the phase offset (i.e., timing offset) **while employing the same carriers as other users." Thus the removal of carriers corresponding to other users is not necessary.**

Accordingly, it is respectfully submitted that the Examiner's apparent reliance on filter 56 as disclosing the recited filtering step of claim 1 is misplaced.

Representative claim 1 is patentable for the reaons discussed above because it recites:

> A method of processing a frequency division multiplexed signal representing a plurality of symbols and including a plurality of tones, a first subset of said plurality of tones being allocated to a first user, the method comprising the steps of:
>
> **performing a time domain to frequency domain transform operation** on the frequency division multiplexed

signal to generate a frequency domain signal there from;

filtering the frequency domain signal to remove tones in said plurality of tones which are not included in said first subset of tones;

performing a frequency domain to time domain transform operation on the filtered frequency domain signal to generate a filtered time domain signal; and

recovering symbols transmitted to the first user from the filtered time domain signal.

The remaining claims rejected under §102(b) based on Shattil are patentable for the same or similar reasons that claim 1 is patentable and/or because the references including Shattil fail to disclose the features cited in the remaining claims.

2. **Independent Claim 20 is patentable**

Claim 20 is patentable because it recites:

A method of processing a received orthogonal frequency division multiplexed signal to generate symbol values, the method comprising;

performing a channel equalization operation on the received OFDM signal **in the time domain**; and

mapping values of the OFDM signal after channel equalization ***at instants in time*** **used to transmit symbol values to symbol values.**

The Examiner rejected claim 20 as being anticipated by the Shattil reference stating:

> Shattil discloses a method ... comprising performing a channel equalization operation on the received OFDM signal in the time domain (Page 7, line 6-7) and mapping values of the OFDM signal after channel equalization at instants in time used to transmit symbol values to symbol values (Fig. 4, 12B and page 7, lines 8-13).

Notably, page 7, lines 6-7 which the Examiner relies upon as showing channel equalization **in the time domain is the very portion of the patent the Examiner relied upon with respect to claim 1 for showing filtering in the frequency domain**. Applicants respectfully submit that there appears to be an inconsistency with the Examiner's interpretation of the reference as applied to claim 20 when considered in light of the interpretation of the reference as applied to claim 1.

Page 7, lines 6-7 of the applied Shattil reference **follows the discussion of the CIMA signal being split into each of the N carriers by filter 56**. Page 7, lines 6-7 state:

> Depending upon how the transmit signal may have been altered by the communications channel, **one of a plurality of gain compensators (not shown) may apply a gain compensation to each component n**.

Accordingly, it is clear by the discussion of gain compensation being applied to each **component** n and the fact that the discussion follows the discussion of splitting the signal into its **n carriers**, that the gain compensation is applied NOT in the time domain but rather in the frequency domain.

Accordingly, col. 7, lines 6-8 clearly do not describe or teach "**performing a channel equalization** operation on the received OFDM signal **in the time domain**" but rather describes some type of processing on components (carriers) which arguably may be considered frequency domain signal processing. **Accordingly, the cited portion of the reference clearly does not show or suggest the time domain equalization operation of independent claim 20.**

Note further that the gain adjustment follows what the Examiner asserts, in the rejection of claim 1at least is a time domain to frequency domain operation allegedly performed by filter 56. **Applicants respectfully request that *the Examiner be prepared to clarify, during the interview to be scheduled, the apparent inconsistency* between the application of the Shattil reference to claims 1 and 20 if the Examiner intends to maintain the rejection of the claims.**

In view of the above discussion, the rejection of claim 20 and claim 21 which depends therefrom should be withdrawn. The rejection of claims 22-23 should be withdrawn for the same or similar reasons.

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3. Independent Claim 24 and the Claims which Depend therefrom are patentable

The rejection of claim 24 which is also based on the Shattil reference should be withdrawn because the applied reference fails to teach disclose or suggest:

> A communications system comprising:
> an orthogonal frequency division multiplexed signal transmitter including:
> a symbol to time instant mapping module **for mapping *a plurality of symbols* to be transmitted to uniformly spaced points in time *within a time period corresponding to a symbol duration*;** and
> an orthogonal frequency division multiplexed signal receiver including:
> a time instant to symbol mapping module for mapping signal values at points in time used to transmit symbols to symbol values.

V. Conclusion

Applicants' representative looks forward to discussing the application, claims and applied references with the Examiner during the interview to be scheduled.

To the extent necessary, a petition for extension of time under 37 C.F.R. 1.136 is hereby made and any required fee is authorized to be charged to the deposit account of Straub & Pokotylo, deposit account number 50-1049.

Respectfully submitted,

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